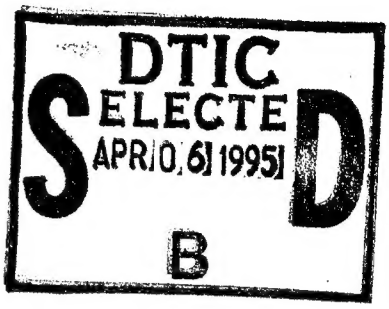
AOARD REPORT

Trip Report - Shonan Institute of Technology, Kanagawa, 28 Mar 94

Mar 28, 94
P. McQuay
AOARD



A visit was made to the laboratory of Prof Tanimoto, of the Shonan Institute of Technology. Prof Tanimoto has a small, but very well equipped fiber reinforced plastic (FRP) composite fabrication and testing laboratory. Highlights of his recent research include utilizing polyethylene dampening interleaf films to improve the fatigue and fracture resistance in carbon fiber/epoxy composites, and characterizing the development and progression of fatigue damage in FRP composites. Impressive improvements have been made in suppressing delamination damage using very low volume fractions of the interleaf films, in various configurations.

AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

ASIAN OFFICE OF AEROSPACE RESEARCH AND DEVELOPMENT

TOKYO, JAPAN
UNIT 45002
APO AP 96337-0007
DSN: (315)229-3212
Comm: 81-3-5410-4409

4 April 1994

MEMORANDUM FOR AOARD

FROM: Capt Paul McQuay

SUBJECT: Trip Report - Shonan Institute of Technology, Kanagawa, 28 Mar 94

1. Abstract:

A visit was made to the laboratory of Prof Tanimoto, of the Shonan Institute of Technology. Prof Tanimoto has a small, but very well equipped fiber reinforced plastic (FRP) composite fabrication and testing laboratory. Highlights of his recent research include utilizing polyethylene dampening interleaf films to improve the fatigue and fracture resistance in carbon fiber/epoxy composites, and characterizing the development and progression of fatigue damage in FRP composites. Impressive improvements have been made in suppressing delamination damage using very low volume fractions of the interleaf films, in various configurations.

2. Shonan Institute of Technology (SIT)

Upon suggestion from Prof Maekawa of the Kyoto Institute of Technology (see TR-94-008), I visited one his colleges, Prof Toshio Tanimoto, of the Department of Materials Science and Ceramic Technology, Shonan Institute of Technology (SIT, or Shonan Kokka Daigaku in Japanese). SIT is a relatively small and focused private university located south of Yokohama in Fujisawa City. It has four principal departments: Materials Science and Ceramic Technology; Electrical Engineering; Mechanical Engineering; and Information Science. In the Department of Materials Science and Ceramic Technology, there are currently 10 professors, with approximately 500 undergraduate and 30 graduate students.

Prof Tanimoto's research areas include C/C and Fiber Reinforced Plastic (FRP) Composites. Professor Tanimoto is the lone structural materials professor in his department, as the remainder of his department specialize in ceramics for electronics, photonics, etc. His laboratory is surprisingly well equipped with several presses, an autoclave, several electo-hydraulic fatigue test machines equipped with wet/dry capability, a thermal fatigue test machine. A surface temperature measuring infrared detector and a magnified CCD camera also used in fatigue testing and tensile testing of composites. He also has a tensile tester equipped with a state-of-the-art acoustic emission (AE) instrumentation in order to evaluate damage propagation in composites.

The department shares a common material processing and fabrication laboratory, used primarily for ceramics, and a well equipped materials characterization facility. SIT has recently installed a new computer lab which houses an impressive fleet brand new Sun SPARCstations, over 150 in all.

One of Prof Tanimoto's major research thrusts is using polyethylene dampening interleaf films to improve the fatigue and fracture resistance in carbon fiber/epoxy composites. Impressive improvements have been made in suppressing delamination damage using very low volume fractions of the interleaf films, in various configurations. Prof Tanimoto has also claimed success in correlating data from surface temperature, AE, visual and ultrasonic

inspection, and classical fractography in determining the failure paths and mechanisms in advanced polymeric composites.

He has helped to develop a new fabrication technique for carbon/PEEK tubes, using a thermally expandable mandrel made of PTFE. He also has a unique fatigue testing rig which tests pipes in multi-axial fatigue: compression-tension; and torsion. He has confirmed a methodology to estimate the fatigue strength at a given life for various combinations of axial and shear stress. He is also beginning a new research program on smart composites, using piezo-electric actuators imbedded in FRP composites.

Prof Tanimoto stressed several times the capability, in terms of equipment and expertise, to accomplish materials development and characterization from materials fabrication through to testing and life prediction, all in his own laboratory. He emphasized this ability as an advantage in developing new materials. Although this is certainly not a unique approach, what is unique is that tall of these capabilities exist in a single professors laboratory. This situation may be due, in part, to the fact that his interests are so divergent from the rest of the faculty, that there is little opportunity for synergistic cooperation within SIT, outside of typical microscopy and spectroscopy.

Near the end of my visit, I briefly described to him the mission and programs of AOARD. He seemed interested in the possibility of research sponsorship, although nothing specific was discussed. As SIT is a private institute, most of the funding for research comes from private and corporate sources, with very little support from the government.

3. Summary

Overall, compared with the national universities, the facilities are modern and well kept, and the laboratories very well equipped. A dramatic example of this is SIT's state-of-the-art computer science laboratories. Prof Tanimoto appears to be conducting some very important research in improving the fatigue properties of FRP composite systems, and has a very well equipped laboratory. Several of Prof Tanimoto's recent publications are available upon request.